School of Engineering
and Applied Science
Center for Railroad Safety-Critical Excellence

ASCAP RSAC BRIEFING
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Briefing Topics

- CSX Punch List Status
  - Traffic Management Algorithm (TMA)
  - Severity – Accident Model
  - Random Number Generator
  - Human-factors
- ASCAP++ Status
  - Object-oriented Standardization
  - Risk Assessment Model Builder
  - Application-independent Simulation Engine
  - Risk Assessment Metrics
  - Accident Severity

TMA Status

- Incorporated data driven scheduler
  - Variable data entry for train departures
  - Reflects schedule changes as provided by FRA
- Incorporated dispatcher response delays
  - Variable
  - Reflects FRA provided data
- Incorporated siding entry/exit delays
  - Fixed values provided by FRA

TMA Status

- Current simulation results use:
  - Original time driven train movement model
  - Original ASCAP TMA assumptions
- FRA Data
  - Average trip time: 383 minutes
  - Trip time Variance: 45 257 minutes^2
  - Trip time Std. Deviation: 212 minutes

$$171 \leq \text{Trip Time} \leq 596$$

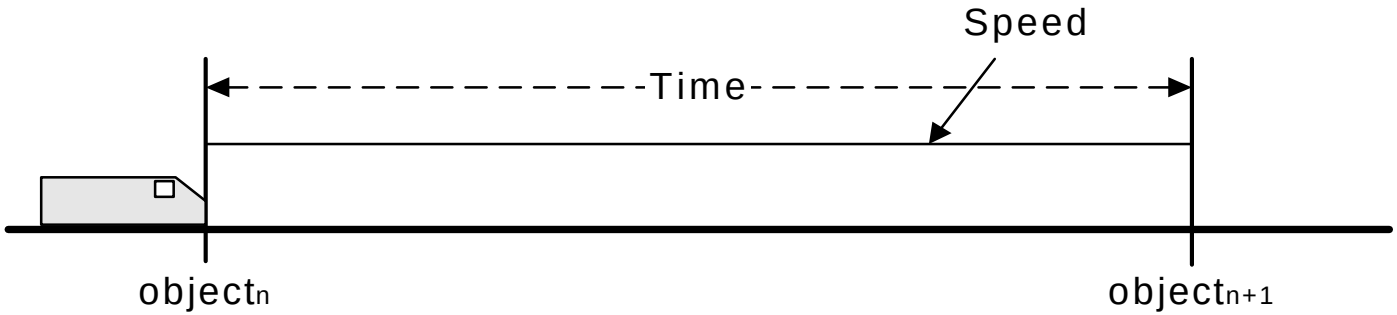
- ASCAP Data
  - Average trip time: 404 minutes
  - Trip time Variance: 51 251 minutes^2
  - Trip time Std. Deviation: 226 minutes

$$178 \leq \text{Trip Time} \leq 630$$

Severity – Accident Model

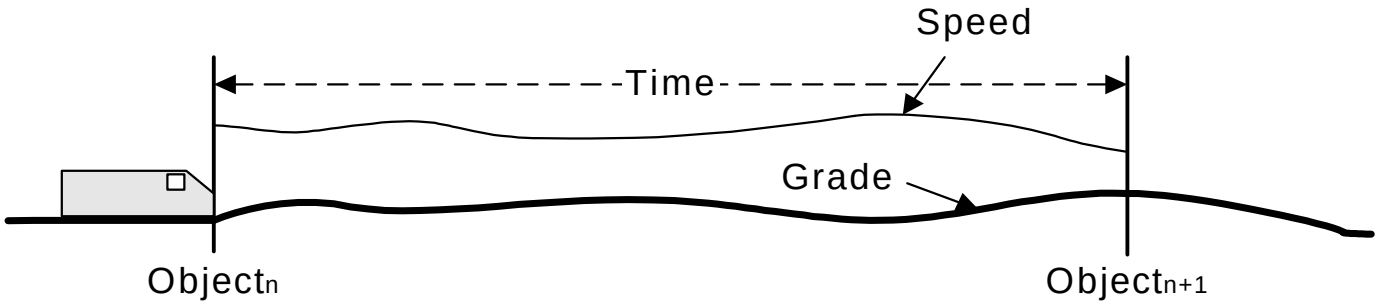
- Severity - Mishap model has been presented to the FRA:
  - Model developed Events Passed at Danger
  - Events Passed at Danger can Result in a Mishap-pair
    - Example: Train-to- Train Collision
  - Historical data is used to evaluate the Societal Cost of a Mishap
  - Societal Cost used to Determine Non Accident or Accident

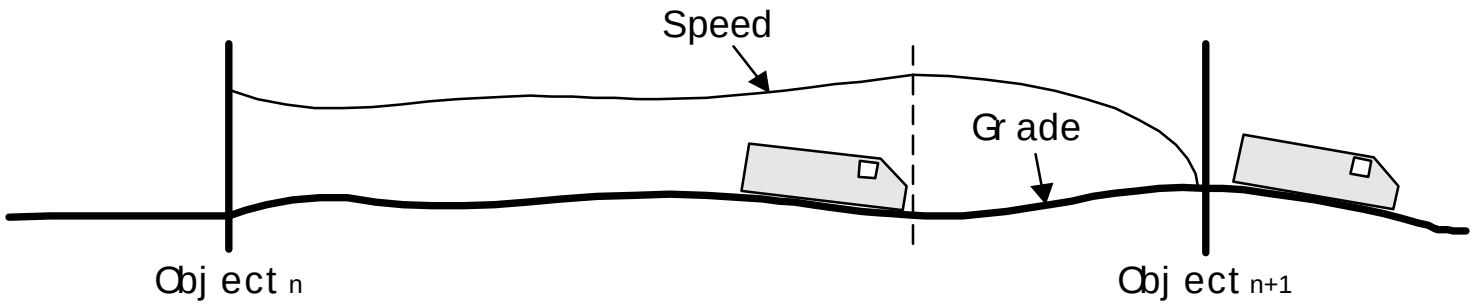
Early Train Model – Constant Speed



Current Train Dynamic Model Improvements

The new train dynamic model has two major improvements in following two scenarios.





Train Dynamic Movement[1]

- PID controller is used to model the variance of the train horsepower or braking pipe pressure which are controlled by train operator.
- Davis equation is applied to calculated the resistances, including journal resistance, roller bearing resistance, non-curve flange resistance, and air resistance.
- Grade forces calculated
- Curve resistance calculated
- Apply the Newton's second law to calculate motion:

$$W\frac{dV}{dt}=\sum F$$

(1) High Calculation Performance Model provided by Terry from the FRA

Random Number Generator

- Validation & Verification Plan Submitted to the FRA
- Experiments have demonstrated that the Random Number Generator does not repeat
- Experiments thus far have tested up to 500,000,000 miles of train travel
- Final experiments will be made with Human-factors Verification

Human-factors

- FRA has provide Human-factors Verification Scenario
- Experiments will be run to verify that ASCAP develops Check Solution Scenario
- Final experiments will include:
  - Events Passed at Danger
  - Verification that ASCAP Human-factors Probabilities are Consistent with the FRA Human-factors Scenarios

CSX Safety Case Closure

- Presentation of the CSX Punch List “White Papers” and Results to be issued: Week of June 17th
- FRA to Schedule Formal “ Expert Team “ Review Meeting

ASCAP++ Block Diagram

ASCAP++ Requirements Status

- Object-oriented Standardization
- WEB-based Risk Assessment Model Builder
- Application-independent Simulation Engine
- Probabilistic Hazard Analysis (PHA) Builder
- Risk Assessment Metrics: Mishaps and Accident Severity
- Performance Events Passed at Danger Logging